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EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1792	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/669,135	KOKTA ET AL.	
	Examiner	Art Unit	
	MATTHEW J. SONG	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 July 2008 and 10 July 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,11-13,16,19-21,23-26 and 31-40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,11-13,16,19-21,23-26 and 31-40* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 1-5, 11-13, 16, 19-20, 23-26, and 31-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grabmaier et al ("Czochralski Growth of Magnesium-Aluminum Spinel" from IDS filed 4/7/2005) in view of Wachi et al (JP 2001-080989), an English translation and abstract is provided, and in view of Robinson et al (US 3,808,065).

In a method of growing a magnesium aluminate spinel using a Czochralski method, note entire reference, Grabmaier et al teaches a single crystal spinel having a composition $(MgO)(Al_2O_3)$ with a ratio oof $MgO:Al_2O_3=3.2$ (pg 356), this clearly suggests applicant's spinel single crystal boule having a formula $aADxbE_2D_3$ when A is Mg, D is O, and E is Al and a ration

b:a greater than 1.5:1. Grabmaier et al also teaches a spinel seed crystal (pg 356). Grabmaier et al also teaches crystals could be sawed unannealed without cracking. Grabmeier et al teaches a melt contained in an iridium crucible (pg 355), this clearly suggests applicant's batch melt in a crucible.

Grabmeier et al is silent to the aspect ratio.

In a method of Czocharalski single crystal growth, note entire reference, Wachi et al teaches the aspect ratio is a result effective variable in a Czochralski process (English Translation [0015]). Wachi et al also teaches producing large diameter compound semiconductor single crystals is the problem to be solved (Abstract), which clearly suggests large diameter crystals are desirable. Wachi et al also teaches a crucible diameter/crystal diameter ratio of 2.2-3.2 (Abstract), which is equivalent to an aspect ratio of 0.3125-0.4545. Overlapping ranges are prima facie obvious (MPEP 2144.05).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Grabmeier et al by optimizing the aspect ratio to be greater than 0.44 in order to maximize the size of the crystal because larger crystals are more desirable, as suggested by Wachi et al.

The combination of Grabmeier et al and Wachi et al does teaches sawing the boule. However, the combination of Grabmeier et al and Wachi et al is silent to the boule is sliced into wafers.

In a method of manufacturing spinel wafers, note entire reference, Robinson et al teaches single crystal spinel boules are sliced into wafers with a diamond saw. Robinson et al also

teaches spinel wafers with smooth surfaces are useful as substrates in the electric integrated circuit art (col 1, ln 1-35).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Grabmeier et al and Wachi et al by slicing the single crystal spinel boule into wafers, as taught by Robinson et al, to form substrates useful in the electronic integrated circuit art.

Grabmeier et al teaches pulling a crystal using a Czochralski method. Grabmeier et al is silent to the crystal being single crystalline. The Czochralski method of growth is conventionally used in art as a method of forming single crystal, as evidenced by Cullen et al (US 3,883,313), and the Czochralski method is the method used by applicant to form a single crystal; therefore it is expected that the same process used by applicant and which is conventionally used to produce a single crystal would produce a single crystal. In the alternative, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Grabmeier et al and Wachi et al by forming a single crystal boule because single crystals have desirable properties, as evidenced by Robinson et al.

Referring to claims 1-5, the combination of Grabmeier et al, Wachi et al and Robinson et al teaches an unannealed crystal, this clearly suggests annealing is substantially eliminated.

Referring to claim 12-13, the combination of Grabmeier et al, Wachi et al and Robinson et al teaches a ratio of 3.2:1, overlapping ranges are held to be obvious (MPEP 2144.05).

Referring to claim 16, a process aspect ratio of greater than 0.44 would have been obvious to one of ordinary skill in the art at the time of the invention, as discussed previously. The combination of Grabmeier et al, Wachi et al and Robinson et al is silent to the aspect ratio

prevents flipping of the crystal orientation. The prevention of flipping of the boule from a [111] orientation to a different orientation is expected to occur because a similar aspect ratio is expected to result in a similar effect.

Referring to claims 19-20, the combination of Grabmeier et al, Wachi et al and Robinson et al teaches a $MgOAl_2O_3$ and a seed crystal (pg 356).

Referring to claim 22, the combination of Grabmeier et al, Wachi et al and Robinson et al teaches a Czochralski method.

Referring to claims 23-26, the combination of Grabmeier et al, Wachi et al and Robinson et al is silent to the cooling rate not less than 50°C/hr. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Grabmeier et al, Wachi et al and Robinson et al by optimizing the cooling rate in order to obtain the claimed cooling rate by conducting routine experimentation because faster cooling rates will increase productivity.

Referring to claim 32-40, the combination of Grabmeier et al, Wachi et al and Robinson et al teaches spinal boules of about 3 inches ('065 col 1, ln 5-35). In regards to the aspect ratio of not less than 0.52 or not less than 0.55 or not less than 0.50, the combination of Grabmeier et al, Wachi et al and Robinson et al teaches aspect ratio is a result effective variable and larger diameter crystals are desirable; therefore it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Grabmeier et al, Wachi et al and Robinson et al by optimizing the aspect ratio to obtain an aspect ratio within the claimed range to produce a large diameter crystal.

3. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Grabmaier et al ("Czochralski Growth of Magnesium-Aluminum Spinel" from IDS filed 4/7/2005) in view of Wachi et al (JP 2001-080989), an English translation and abstract is provided, and in view of Robinson et al (US 3,808,065) as applied to claims 1-5, 11-13, 16, 19-20, 23-26, and 31-40 above, and further in view of Li (US 5,968,267).

The combination of Grabmeier et al, Wachi et al and Robinson et al teach all of the limitations of claim 21, as discussed previously, except rotating the crucible.

In a Czochralski method of crystal growth, note entire reference, Li teaches its is common practice is a Czochralski process to rotate the seed about its longitudinal axis during the pulling process in order to grow a crystal with a more uniform cross section and the crucible holding the melt may also be rotated to grow a crystal with a more uniform cross section (col 2, ln 35-65).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Grabmaier et al and Robinson et al by rotating the rotating the crucible, as taught by Li, to grow a crystal with a more uniform cross section.

4. Claims 1-5, 11-13, 16, 19-20, 23-26, and 31-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cullen et al (US 3,883,313) in view of Wachi et al (JP 2001-080989), an English translation and abstract is provided, and in view of Robinson et al (US 3,808,065).

In a method of growing a magnesium aluminate spinel using a Czochralski method, note entire reference, Cullen et al teaches a single crystal spinel having a composition $(MgO)(Al_2O_3)_x$ where x can be between 1 and 2.3 (Abstract), this clearly suggests applicant's spinel single

crystal boule having a formula $aADxbE_2D_3$ when A is Mg, D is O, and E is Al and a ration b:a greater than 1.5:1 because overlapping ranges are held to be obvious. Cullen et al also teaches a spinel seed crystal with a desired orientation of (111) or (100) (col 2, ln 35-67). Cullen et al also teaches boules having a diameter of about 2 inches can be pulled (col 3, ln 50-67).

Cullen does not specifically teach an aspect ratio of greater than 0.44.

In a method of Czocharalski single crystal growth, note entire reference, Wachi et al teaches the aspect ratio is a result effective variable in a Czochralski process (English Translation [0015]). Wachi et al also teaches producing large diameter compound semiconductor single crystals is the problem to be solved (Abstract), which clearly suggests large diameter crystals are desirable. Wachi et al also teaches a crucible diameter/crystal diameter ratio of 2.2-3.2 (Abstract), which is equivalent to an aspect ratio of 0.3125-0.4545. Overlapping ranges are prima facie obvious (MPEP 2144.05).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Cullen et al by optimizing the aspect ratio to be greater than 0.44 in order to maximize the size of the crystal because larger crystals are more desirable, as taught by Wachi et al. Furthermore, Figure 1 of Cullen suggests a large aspect ratio because the crystal is approximately the size of the crucible.

The combination of Cullen et al and Wachi et al is silent to the boule is sliced into wafers.

In a method of manufacturing spinel wafers, note entire reference, Robinson et al teaches single crystal spinel boules are sliced into wafers with a diamond saw. Robinson et al also

teaches spinel wafers with smooth surfaces are useful as substrates in the electric integrated circuit art (col 1, ln 1-35).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Cullen et al and Wachi et al by slicing the single crystal spinel boule into wafers, as taught by Robinson et al, to form substrates useful in the electronic integrated circuit art.

Referring to claims 1-5, the combination of Cullen et al, Wachi et al and Robinson et al does not teach annealing the crystal, this clearly suggests annealing is substantially eliminated.

Referring to claim 12, the combination of Cullen et al, Wachi et al and Robinson et al teaches a ratio of 2.3:1. (MPEP 2144.05).

Referring to claim 13, the combination of Cullen et al, Wachi et al and Robinson et al al teaches a ratio of 2.3:1. The combination of Cullen et al, Wachi et al and Robinson et al does not teach a ratio of greater than 2.5:1. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Cullen et al, Wachi et al and Robinson et al by changing the composition to obtain the claimed composition because changes in concentration are held to be obvious (MPEP 2144.05) and ratios of up to 3.2:1 are known in the art to result in mechanically stable crystals, as evidenced by Grabmeier et al ("Czochralski Growth of Magnesium-Aluminum Spinel").

Referring to claim 16, a process aspect ratio of greater than 0.44 would have been obvious to one of ordinary skill in the art at the time of the invention, as discussed previously. The combination of Cullen et al, Wachi et al and Robinson et al is silent to the aspect ratio prevents flipping of the crystal orientation. The prevention of flipping of the boule from a [111]

orientation to a different orientation is expected to occur because a similar aspect ratio is expected to result in a similar effect.

Referring to claims 19-20, the combination of Cullen et al, Wachi et al and Robinson et al teaches $MgOAl_2O_3$ and a seed crystal (pg 356).

Referring to claims 23-26, the combination of Cullen et al, Wachi et al and Robinson et al is silent to the cooling rate not less than 50°C/hr. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Cullen et al, Wachi et al and Robinson et al by optimizing the cooling rate in order to obtain the claimed cooling rate by conducting routine experimentation because faster cooling rates will increase productivity.

Referring to claims 32-40, the combination of Cullen et al, Wachi et al and Robinson et al teaches spinal boules of about 2 inches ('313 col 3, ln 60-67). In regards to the aspect ratio of not less than 0.52 or not less than 0.55 or not less than 0.50, the combination of Cullen et al, Wachi et al and Robinson et al teaches aspect ratio is a result effective variable and larger diameter crystals are desirable; therefore it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Cullen et al, Wachi et al and Robinson et al by optimizing the aspect ratio to obtain an aspect ratio within the claimed range to produce a large diameter crystal.

5. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cullen et al (US 3,883,313) in view of Wachi et al (JP 2001-080989), an English translation and abstract is

provided, and in view of Robinson et al (US 3,808,065) as applied to claims 1-5, 11-13, 16, 19-20, 23-26, and 31-40 above, and further in view of Li (US 5,968,267).

The combination of Cullen et al, Wachi et al and Robinson et al teach all of the limitations of claim 21, as discussed previously, except rotating the crucible.

In a Czochralski method of crystal growth, note entire reference, Li teaches its is common practice is a Czochralski process to rotate the seed about its longitudinal axis during the pulling process in order to grow a crystal with a more uniform cross section and the crucible holding the melt may also be rotated to grow a crystal with a more uniform cross section (col 2, ln 35-65).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Cullen et al, Wachi et al and Robinson et al by rotating the rotating the crucible, as taught by Li, to grow a crystal with a more uniform cross section.

Response to Arguments

6. Applicant's arguments with respect to claims 35-40 have been considered but are moot in view of the new ground(s) of rejection.

7. Applicant's arguments filed 7/10/2008 have been fully considered but they are not persuasive.

Applicant's argument that conventional wisdom would lead those of ordinary skill in the art single crystal growth arts to work at process aspect ratios of less than 0.44 is noted but not found persuasive. First, this is a mere allegation of patentability and lacks evidence; therefore is

not persuasive. Second, Wachi et al also teaches a crucible diameter/crystal diameter ratio of 2.2-3.2 (Abstract), which is equivalent to an aspect ratio of 0.3125-0.4545; therefore aspect ratios greater than 0.44 have been used in the art of Czochralski crystal growth.

Applicant's argument that the teachings of Wachi cannot be applied to other crystal systems is noted but not found persuasive. Wachi is relied upon to teach that aspect ratio is a result effective variable in the Czochralski process. The Czochralski process is the method of crystal growth used by the Grabmaier and Cullen references. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the Czochralski process taught by the Grabmaier and Cullen references by optimizing a result effective variable. Wachi is evidence that aspect ratio in a Czochralski process is a result effective variable and aspect ratios within the claimed ranges are conventionally known in the art.

Applicant's argument that Wachi teaches away from higher aspect ratios is noted but not found persuasive. Wachi teaches an optimal range for aspect ratios for a GaAs system. Wachi is relied upon for the general teaching that aspect ratio is a result effective variable in a Czochralski crystal growth process. Clearly the optimal range will be expected to vary depending on the crystal system. Therefore, by conducting routine experimentation a person of ordinary skill in the art would determine the optimal range for the claimed crystal system requires higher aspect ratios.

The Declaration under 37 CFR 1.132 filed 7/28/2008 is insufficient to overcome the rejection of claims 1-5, 11-13, 16, 19-21, 23-26, and 31-40 based upon the rejection over Cullen et al (US 3,883,313) in view of Robinson et al (US 3,808,065) or Grabmaier et al ("Czochralski

Growth of Magnesium-Aluminum Spinel" from IDS filed 4/7/2005) in view of Robinson et al (US 3,808,065) as set forth in the last Office action because: the declaration fails to set forth facts showing the process aspect ratio produces unexpected results and are not commensurate with the scope of the invention. The declaration merely states conclusionary statements without evidence. The only evidence supporting unexpected results is within applicant's original disclosure. On page 8 of applicant's original specification, there is a table of results which shows that an aspect ratio of 0.44 does not produce that alleged unexpected result, note at a pull rate of 1 mm/hr and an aspect ratio of 0.44 a <111> crystal is not produced. Clearly there are other result effective variables that are required to achieve a <111> crystal. Furthermore, the declaration is not commensurate with the scope of the invention because the claimed invention does not require producing a <111> crystal. The declaration also merely states that the Wachi range of process aspect ratios are limited to the GaAs system. This statement lacks evidence and is also not supported by the Wachi reference. First, Wachi clearly teaches GaAs is merely an example and the approach can be applied to other compound semiconductors single crystals, such as InP, GaP and InAs, grown using the Czochralski method. Second, the Examiner's position is that aspect ratio is a result effective variable for a Czochralski process and one of ordinary skill in the art would have to conduct routine experimentation to determine the optimal aspect ratio for a given crystal material. The Czochralski process is a well known process of crystal manufacturing for a large variety of materials and Wachi merely relied upon to teach that aspect ratio is a result effective variable for the Czochralski process.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW J. SONG whose telephone number is (571)272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on 571-272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song
Examiner
Art Unit 1792

MJS
October 26, 2008

/Robert M Kunemund/
Primary Examiner, Art Unit 1792